



CORPORATE PURCHASING SPECIFICATION

AA 120 22

Rev. No. 05

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RECTANGULAR COPPER RODS - ANNEALED (WITH EDGE WISE BENDING)

1.0 GENERAL:

This specification governs the quality requirements of rectangular copper rods in annealed condition with edgewise bending over 6mm and upto including 125mm thickness.

2.0 APPLICATION:

Used in winding of electrical machines such as end rings of squirrel cage motors, etc., which require severe edgewise bending.
Refer AA 12008 for rectangular and round copper rods for normal applications.

3.0 CONDITION OF DELIVERY:

The copper rods shall be supplied in annealed condition in straight lengths. Rectangular bars shall be supplied with radiused edges to clause 5.3.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The copper rods shall comply with the requirements of the following national standard and also meet the requirements of this specification.

IS: 613- 2000 , Condition : Annealed : Copper Rods and Bars For Electrical purposes

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

Copper rods shall be supplied to the dimensions specified in BHEL order / drawing.

5.2 Tolerances:

5.2.1 Diameter/Across flats:

The tolerances on diameter / across flats shall comply to the normal tolerances as per Table 3 of IS:2826.

5.2.2 Length:

Tolerance on length shall be as follows:

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Length, mm		Tolerances, $\pm$ mm
Over	Upto & incl.	
-	150	1.2
150	1200	1.5
1200	2400	2.5
2400	-	5.0

5.2.3 Straightness:

The edges of rods shall not vary from a straight line by more than 5 mm in any 1000 mm length for rods upto 50mm thick.

5.3 Radius on Edges:

Thickness, mm		Edge radius, mm	Tolerance on radius $\pm$ mm
Over	Upto and incl.		
6	25	2.5	0.25
25	50	3.2	0.25
50	--	As agreed between BHEL and manufacturer	

6.0 MANUFACTURE:

The copper rods shall be manufactured from copper of ETP grade conforming to IS: 191.

The conductor shall be manufactured from ETP grade copper conforming to BHEL specification AA 120 24: Electrolytic Tough Pitch Copper Wire/Bars/Ingots/Continuously cast wire rods.

Note: It is preferable to manufacture conductor from continuously cast copper rods provided all other parameters and conditions remain same."

7.0 FREEDOM FROM DEFECTS:

The copper rods shall be clean, bright, smooth and free from fins, spills, scaling, blisters, cracks and other defects.

8.0 CHEMICAL COMPOSITION:

The analysis of copper when analyzed in accordance with IS 440 or by any other Conventional/ Instrumental method shall be as follows:

Element	Percent, min.	Percent, max.
Copper and Silver	99.90	-
*Bismuth	-	0.001
*Lead	-	0.005
Total of all impurities excluding silver and oxygen.	-	0.030



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* These elements need not be determined when the material supplied conforms with the mechanical and electrical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.

9.0 TEST SAMPLES:

One sample per size per melt per consignment of 3 tonnes or part thereof shall be taken for chemical, mechanical and electrical tests.

The sample shall be cut off cold and shall receive no further treatment before being tested .

10.0 MECHANICAL PROPERTIES:

10.1 Tensile Strength:

The test samples, when tested in accordance with IS: 1608 shall show the following properties:

<u>Cross-sectional Dimension, mm</u>		<u>Tensile strength, N/mm²,max.</u>	<u>Elongation on 4√A or 50mm G.L., percent, minimum</u>
Over	Upto & incl.		
6	12	240	40
12	50	230	45
50	--	As agreed between BHEL and manufacturer.	

10.2 Edgewise bending:

The copper rods when bent on edge through an angle of 180° over a mandrel of radius equal to half the width of the rod shall withstand without showing any signs of failure or crack.

10.3 Hardness (Vickers):

When tested in accordance with IS:1501, the copper rods shall have a Vickers hardness not exceeding of 60 HV.

11.0 ELECTRICAL RESISTIVITY (As Received):

When measured in accordance with IS: 3635, the electrical resistivity of the sample in as received condition at 20° C shall not be greater than 0.01737 ohm mm² / metre, which is equivalent to an electrical conductivity of 99.25%, minimum of IACS standard. (Refer Appendix B of IS: 613 for temperature correction factor.)

Alternatively, the method of measurement employing eddy current probes as per ASTM E 1004 is also acceptable.

12.0 CHECK LIST:

The supplier shall fill up the enclosed checklist as per Annexure-A and submit the same alongwith each batch.

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13.0 INSPECTION AT SUPPLIER'S WORKS:

Whenever specified, tests and inspection are to be conducted in the presence of BHEL'S representative .

The supplier shall offer BHEL's representative all reasonable facilities, without charge to satisfy the latter that the material is being furnished in accordance with this specification. The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his carrying out the prescribed tests elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and testing.

BHEL reserves the right to test the material at BHEL'S works and the final acceptance of the material shall be based on these test results.

14.0 TEST CERTIFICATES:

Unless otherwise stated, three copies of test certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to send one copy of test certificates along with the despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA 12022, Rev. No. 05 : Rectangular Copper Rods - Annealed (with edgewise bending)
BHEL Order No.

Manufacturer 's / Supplier 's Name

Lot /Identification / Batch /Melt No.

Sizes and Quantity Supplied

Results of dimensional inspection, Chemical analysis,

Mechanical and electrical tests as per this specification.

15.0 PACKING AND MARKING:

The copper rods shall be suitably packed to prevent damage during transit.

Each package shall be legibly marked or labeled with the following information.

AA 12022 : Rectangular Copper Rods - Annealed (with edgewise bending)
BHEL Order No

Manufacturer's/ supplier's Name

Lot/Identification/ Batch /Melt No.

Size and Quantity supplied.

16.0 REFERRED STANDARDS(LATEST PUBLICATION INCLUDING AMENDMENTS):

- | | | | | |
|-------------|-------------|----------------|-------------|--------------|
| 1) IS:191 | 2) IS:440 | 3) IS:613 | 4) IS:1501 | 5) IS:1608 |
| 6) IS: 2826 | 7) IS: 3635 | 8) ASTM E 1004 | 9) AA 12008 | 10) AA 12024 |



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ANNEXURE - A (Clause 12.0)

CHECK LIST FOR AA 120 22: RECTANGULAR COPPER RODS – ANNEALED (WITH EDGEWISE BENDING)

(To be filled by Supplier)

- A. Name of Principal Supplier :
- B. Name of Indian Agent :
1. Grade of material as per specification : Yes/No
2. Tolerance on diameter/ across flats/radius on edge/ length and flatness as per specification and drawing : Yes/No
3. Chemical composition as per specification : Yes/No
4. Mechanical properties as per specification : Yes/No
5. Electrical Resistivity : Yes/No
6. Tests : (1) Bend
7. Details of previous experience enclosed : Yes/No.
(For New suppliers only)
- C. Deviations taken (Please specify clearly, if any) : Yes/No.
1
2
3

Date:

Signature &

Place:

Seal of Supplier